

POMERANCHUK, I. YA.

USSR/Nuclear Physics - Cross Sections

May 52

"Exchange Collisions of Fast Nucleons With Deuterons. II," I. Ya. Pomeranchuk

"Zhur Eksper i Teoret Fiz" Vol XXII, No 5, pp 624-627

Obtains effective cross section for exchange collisions of fast nucleons with deuterons for which the momenta of slow nucleons are given. The possibility of analyzing the spin dependence of the exchange forces is seen in the eptl study of such collisions. Received 8 Sep 51.

215T58

POMERANCHUK, I. YA.

USSR :

Electrons produced in the capture of μ -mesons into atomic levels. B. L. Ioffe and I. Ya. Pomeranchuk. *Zhur. Eksp. i Teor. Fiz.* 23, 125-4 (1952); *Science Abstr.* 56A, 478 (1953). — The no. of Auger electrons accord. with the mesonic transitions $2s_{1/2} \rightarrow 2p_{1/2}$ and $2s \rightarrow 1s$ are estd. (3×10^4 sec.⁻¹ and 2.4×10^3 sec.⁻¹, resp., for $Z = 8$). K. L. C.

3/2

AMX

POMERANCHUK, I. YA.

PA 245167

USSR/Nuclear Physics - Neutrons on 21 Nov 52
Protons

"Emission of High-Energy Gamma Quanta During
Collisions of Fast Neutrons With Protons,"
I. Ya. Pomeranchuk and I. M. Shmushkevich

"Dok Ak Nauk SSSR" Vol 87, No 3, pp 385-387

State that photofission of deuterons is easily
investigated both theoretically and experi-
mentally for energies of gamma quanta up to 20
Mev. Discuss the difficulties encountered in the
case of higher energies. Submitted by Acad L. D.
Landau 25 Sep 52.

245167

(PA 56 no. 672:8684 '53)

PA 240194

POMERANCHUK, I.

USSR/Physics - Paramagnetism

21 Dec 52

"Paramagnetic Dispersion," A. Akhiezer and
I. Pomeranchuk

"DAN SSSR" Vol 87, No 6, pp 917, 918 *Jan*

Introduce definition of "magnons" (certain deviations from distribution of magnetic electron moments which are propagated in a crystal in form of a wave) and assume that they obey Fermi-Dirac statistics. Attempt to explain why susceptibility of paramagnetic dielectrics becomes independent of temp at low temps. (cf. B. Cabrera, Rep Inst Phys Solvay, 6, 183, 1932). Presented by Acad L. A. Landau 11 Oct 52.

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POMERANCHUK, I. YA.

USSR.

550. Radiation of γ -rays upon collision of fast π -mesons with nucleons: I. D. LANDAU AND I. YA. POMERANCHUK. Zh. eksper. teor. Fiz., 24, No. 1, 1957, 15-19, 15 figs. Russian.

The bremsstrahlung of γ -rays is calculated for π -mesons which are absorbed by a "black" nucleon and, therefore, produce diffraction scattering. For large energies, $E \gg \mu$, where μ is the π -meson rest energy, it is shown that only the region outside the nucleon contributes appreciably to this process, and the π -meson wave-function is known in this region as a sum of plane waves and diffracted waves. Radiation accompanying the capture of the π -meson is also calculated. The differential cross-section for radiation is found to be small compared to πR^2 except for small angles, $\theta < \mu/E$, where it becomes large with increasing energy.

G. H. BROWN *MBL*

POMERANCHUK, I. YA.

USSR/Nuclear Physics - Cosmic Rays' Origin

"The Origin of Cosmic Rays and Radio-Astronomy," V. L. Ginzburg

Usp Fiz Nauk, Vol 51, No 3, pp 343-392

A review of current literature, Western and Soviet, on the subjects: cosmic radio-emanation and electron component of cosmic rays; movement of charged particles in interstellar space; the statistic mechanism governing the acceleration of particles in interstellar space and in the shells of stars; theory of the solar origin of cosmic rays; the theory that supernovae and novae are the probable sources of cosmic rays. Cites 30 Western and 25 Soviet references: Ya. P. Terletskiy, G. G. Getmantsev, I. S. Shklovskiy, L. A. Artsimovich, I. Ya. Pomeranchuk, V. V. Vladimirskiy, A. A. Sokolov, I. N. Gordon (DAN USSR, No 3, 1953), V. I. Vol'danskiy A. L. Lyubimov, B. V. Medvedev, A. A. Logunov, L. E. Gurevich, and S. Z. Belen'kiy.

272T54

POMERANCHUK, I.

USSR/Nuclear Physics - Electrons

21 Sep 53

"Limits of Applicability of the Bremsstrahlung Theory of Electrons and of Pair Formation at High Energies," Acad L. Landau and I. Pomeranchuk

Dokl.

DAN SSSR, Vol 92, No 3, pp 535-536

Analyze Bethe-Heitler's formulas for Bremsstrahlung (C.F. Weizsaecker, Z f Phys 88 (1934)). Conclude that these formulas are not applicable to high energies. Find that inapplicability also holds for the formation of pairs. Rec 22 Jul 53.

268T84

B.T.R. June 1954 -

POMERANCHUK, I.

B. T. R.
June 1954
Physics

(2) 3
8776° Electron-Avalanche Processes at Ultra-High Energies. (Russian.) I. Landau and I. Pomeranchuk. *Doklady Akademii Nauk SSSR*, v. 92, no. 4, Oct. 1, 1953, p. 735-738.
Investigates rational processes under conditions in which theory developed by Bethe and Heitler, of "braking" radiation of electrons and positrons and of formation of electron-positron pairs by γ -quanta, is incorrect. 2 ref.

JS
10/6/54

POMERANCHUK, I. YA.

USSR 1

539.172 : 530.145

4919. On external (diffractive) production of particles in nuclear reactions. I. YA. POMERANCHUK AND E. L. FELDBERG. Dokl. Akad. Nauk SSSR, 93, No. 3, 439-41 (1953) In Russian.

In high-energy ($E > 10^9$ eV) diffractive scattering of nucleons by nuclei, nuclear recoil can become large enough to enable the nucleus to emit a γ -ray or μ -meson. The effective region in which this production occurs can lie outside the nucleus for energies of the incident particle $E > A^{1/2}Mc^2$, where A is atomic number and M is mass of incident nucleon. An order-of-magnitude estimate of the cross-section for this external production is given. G. S. BROWN

Handwritten: Nuclei 1-PM-003

Handwritten: ENM

POMERANCHUK, I. Ya.

USSR/Physics - Quantum electrodynamics

Card 1/1 : Pub. 118 - 7/9

Authors : Abrikosov, A. A.; Pomeranchuk, I. Ya.; and Shmushkevich, I. M.

Title : "Quantum Electrodynamics" by A. I. Akhizer and B. B. Berestetskiy.
Gosizdat, 1953, 428 p.

Periodical : Uspe^{sh} fiz. nauk 53/3, 442-444, July 1954

Abstract : A monographical work by two Soviet scientists is reviewed. The monograph deals with quantum electrodynamics and is considered to be a unique and very valuable work on theoretical physics.

Institution : ...

Submitted : ...

POMERANCHUK, I. Ya.

2-1-BML

Photon emission accompanied by the capture of a fast
proton by the nucleus. A. I. Akhiezer and I. Ya. Pomer-
anchuk. Doklady Akad. Nauk S.S.S.R. 94: 621-3 (1954).
ND 49: 12978a. —Math. An expression is derived for
euleg. the cross section for photon emission due to the cap-
ture of protons by a nucleus. J. Roviar Leach. ①

BML 12/22

USSR/Physics POMERANCHUK, I. YA.

Card 1/1

Author : Pomeranchuk, I. Ya., Memb. corresp. of AN SSSR

Title : Semi-phenomenological theory of formation of π -meson pairs by gamma-quanta of greater energies

Periodical : Dokl. AN SSSR, 96, Ed. 2., 265 - 268, 1954

Abstract : The possibility of formulating a semi-phenomenological theory of formation of π -meson pairs by gamma-quanta which is analogous to the theory of emission of gamma-quanta by π -mesons usually originates at greater energies of gamma-quanta. The nuclei (including protons) can be considered as black globules relative to π -mesons of greater energy. This is the result of intensive interaction between π -mesons and nuclei. By using the "blackness" of nucleons one can determine the wave function ψ of π -mesons outside of the nucleus as the sum of the plain and diffracted waves. Formulas supporting this theory are presented. Six references; L USSR since 1948.

Institution :

Submitted : March 5, 1954

ПОМЕРАНЧУК, Л. УА.

5

U S S R .

Formation of π -meson pairs by γ -quanta in the case of heavy nuclei. L. Ya. Pomeranchuk. *Doklady Akad. Nauk S.S.S.R.* 96, 481-484 (1954) (English translation in *ibid.*, 205-8). P. has formulated a semiphenomenological theory of π -meson pair production by photons in the field of a nucleus. It is now shown that the matrix element of the transition can be considerably simplified if the nuclear radius R is large compared with the Compton wave length of the π -meson. For the partial differential cross section an expression is obtained in terms of $k = k_1 + k_2$ and $b = (k_1 - k_2)/2$, where k_1 and k_2 are the momenta of the π -mesons. This expression has a max. for $k \sim 1/R$, but its dependence upon b is detd. by the "extension" of the π -meson and by the characteristics of the interaction. The total cross section for the production of a pair of charged π -mesons is independent of the energy of the incident photon and is of the order of magnitude $(e^2/10 \hbar c) R^2$. The cross section for the production of a pair of neutral π -mesons is much smaller.

B. Gora

POMERANCHUK, I. Ya.

USSR/Physics - Quantum theory

Card 1/1 Pub. 22 - 10/48

Authors : Galanin, A. D.; Ioffe, B. L.; and Pomeranchuk, I. Ya., Memb. Corresp. of AN.

Title : Re-standardization of mass and charge in covariant equations of quantum field theory

Periodical : Dok. AN SSSR 98/3, 361-364, Sep 21, 1954 *del*

Abstract : The purely physical arguments regarding the necessity of substituting fictitious mass and charge by experimental ones in the restandardization of mass and charge in covariant equations of quantum field theory, are analyzed. Such substitution was recommended regardless of the fact whether the mass and polarization operators are finite or infinite. An example of actual work on the restandardization of mass and charge in covariant equations is presented. Four references: 3-USA and 1-USSR (1949-1954).

Institution : ...

Submitted : February 22, 1954

"APPROVED FOR RELEASE: 07/13/2001

CIA-RDP86-00513R001342030006-2

1955-

APPROVED FOR RELEASE: 07/13/2001

CIA-RDP86-00513R001342030006-2"

POMERANCHUK, I. Ya.

POMERANCHUK, I. Ya., KUREVICH, I. I., SHIVAK, F. Ye., YEROZOLIMSKIY, V. G., and
STOLYAROV, G. A.

"Theory of Resonance Absorption in Heterogeneous Systems".

Report appearing in 1st Volume of "Session of the Academy of Sciences USSR on
the Peaceful use of Atomic Energy, 1-5 July 1955", Publishing House of Academy
of Sciences USSR, 1955.

Leningrad Physicotechnical Institute, Academy of Sciences USSR.

SO: Sum 728, 28 Nov 1955.

GUREVICH, I.I.; POMERANCHUK, I.Ya.

[Theory of resonance absorption in heterogeneous systems] Teoriia
rezonansnogo pogloshcheniia v geterogennykh sistemakh. Moskva,
1955. 18 p. (MIRA 14:6)
(Nuclear resonance and relaxation)

POMERANCHUK, I. YA.

✓ The asymptotics of the Green function of the nucleon and meson in the pseudoscalar theory, at weak interaction. A. D. Galanin, B. L. Ioffe, and I. Ya. Pomeranchuk. *Zhur. Eksp. i Teor. Fiz.* 29, 51-63 (1955). — The asymptotics for $|p| \gg m$ is studied of the Green function of nucleon and meson in the pseudoscalar (with scalar continuity) theory with small binding consts. The calcn. starts out with the equation of Landau, *et al.* (*Doklady. Akad. Nauk S.S.S.R.* 95, 497, 773, 1177; 96, 201 (1954)). In contrast to the results by L., *et al.*, a restandardization of the mass is found, also of the charge, if one uses the method which was developed by G., *et al.* (*ibid.* 98, 301), and it is shown that this method removes all apparent infinity in the given problem. Werner Jacobson

(2)

USSR/Nuclear Physics - Mu-meson pair production

FD-3258

Card 1/1 Pub. 146 - 17/44

Author : Berestetskiy, V. B.; Pomeranchuk, I. Ya.

Title : Letter to the editor. Production of mu-meson pair during annihilation of a positron

Periodical : Zhur. eksp. i teor. fiz., 29, No 6(12), Dec 1955, 864

Abstract : According to the authors, if mu-mesons do not have peculiar to them any specific interaction more essential than electromagnetic interaction, then experimental investigation of electrodynamic processes with the participation of mu-mesons can give important information concerning the limits of applicability of the modern field theory and concerning the character of physical laws close to this limit, since the Compton wavelength of the mu-meson is comparable with those dimensions close to which one can expect radical changes in space-time concepts (I. Ya. Pomeranchuk, DAN SSSR, 103, 1005; 104, 51, 1955). They claim that deviation of experimental data from the formula for the effective cross-section of mu-meson pair production in the collision of positron with electron at rest should give information on maximum cross-section, minimum energy E_n of such pair production, etc.

Institution : Academy of Sciences USSR

Submitted : September 29, 1955

Translation D 419.421 - p.53

FD-3262

USSR/Nuclear Physics - Pseudoscalar meson theory

Card 1/1

Pub. 146-21/44

Author

: Pomeranchuk, I. Ya.

Title

: Solving the equations of the pseudoscalar meson theory with pseudoscalar bond

Periodical

: Zhur. eksp. i teor. fiz., 29, No 6(12), Dec 1955, 869-871

Abstract

: Earlier (DAN SSSR, 104, 51 and 105, 3, 1955) the author analyzed the problem of renormalization of meson charge g and found that the expressions found by A. A. Abrikosov and I. M. Khalatnikov (DAN SSSR, 103, 993, 1955) for the peak portion γ , the Green functions of nucleon G and Green functions of meson D are correct not only for g_1 much less than 1 (g_1 is nonrenormalized meson charge) but also for any value of g_1 . In the present note the author analyzes with greater completeness one point in these assertions, namely concerning the influence of scattering of meson upon the peak part. He demonstrates that the expressions G , D , and γ in the pseudoscalar meson theory turn out to be equal to the pseudoscalar bond with suitable assumptions as to the momenta of nucleons and mesons (i. e. greater in the case of nucleons). Four references: e. g. L. D. Landau, A. A. Abrikosov, I. M. Khalatnikov, DAN SSSR, 95, 497, 1954.

Institution : Academy of Sciences USSR

Submitted : September 24, 1955

POMERANCHUK, I.

USSR/ Physics

Card 1/1 Pub. 22 - 18/62

Authors : Landau, L., Academician; and Pomeranchuk, I., Member-Correspondent of the Acad. of Sc., USSR

Title : On the point interaction in quantum electrodynamics

Periodical : Dok. AN SSSR 102/3, 489 - 492, May 21, 1955

Abstract : The method of "smearing" interaction for solving quantum electrodynamic equations describing a point interaction between quanta and electrons is presented. The method is based on the consideration of the interaction as a limit of a certain "smeared" interaction of a finite variable radius \wedge which decreases down to 0. Seven references: 3 USSR, 2 USA, 1 Germ., and 1 Span. (1934-1954).

Institution :

Submitted :

POMERANCHUK, I.

Pomeranchuk, I. Equality to zero of the renormalized charge in quantum electrodynamics. Dokl. Akad. Nauk SSSR (N.S.), 103 (1955), 1005-1008. (Russian)
The title of this paper is intended to imply that quantum electrodynamics with plane interactions is inconsistent for any non-zero value of the physical electron charge.

What is in fact proved is that a particular form of cut-off theory with two cut-off momenta [see the paper reviewed above] does not tend to a reasonable limit as the cut-off momenta tend to infinity. The argument is quite simple. It is proved that in the cut-off theory, when the two cut-offs are related by the inequality

$$\log(\Lambda_p^2/\Lambda_k^2) \gg 1,$$

the only effect which goes to infinity with $\log \Lambda_p^2$ is the charge-renormalization; all other effects are cut down by the smaller cut-off Λ_k^2 and can be made as small we please by increasing Λ_p^2 sufficiently. The relation between ϵ and the unrenormalized charge e_1 is then

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Pomerancuk, I.

$$e^2 = e_1^2 [1 + (e_1^2/3\pi) \log (\Lambda_p^2/m^2)]^{-1},$$

a result which (because of the double cut-off) holds asymptotically in the limit $\Lambda_p \rightarrow \infty$ and is independent of perturbation theory. When $\Lambda_p \rightarrow \infty$, this implies $e_1^2 = 0$, irrespective of the behavior of e_1 .

The reviewer believes that the question, whether or not quantum electrodynamics is consistent, is still open. The author shows that one possible cut-off theory does not lead to a consistent limit as the cut-off tends to infinity; this is an interesting result but does not settle the question, because many other limiting processes might be used and might lead to consistent limits. The question of consistency cannot be adequately discussed without also raising the question of uniqueness.

F. J. Dyson.

2/2

PDW 221

POMERANCHUK, I.

Pomeranchuk, I. On renormalization of meson charge in pseudoscalar theory with pseudoscalar coupling. Dokl. Akad. Nauk SSSR (N.S.) 104 (1955), 51-53. (Russian)

In this note, it is argued that the quantum field theory of pseudo-scalar mesons coupled to nucleons by pseudo-scalar coupling is inconsistent except when the renormalized coupling constant is zero. To reach this conclusion the author studies the behavior of Green's functions of the nucleon and meson in the theory with double cut-off of Abrikosov and Halatnikov (same Dokl. (N.S.) 103 (1955), 993-996; MR 17, 565). Diagrams containing crossed meson lines and meson-meson scattering are neglected in the calculations. An expression of the type

$$g^2 = g_0^2 \{1 + \pi^{-1} g_0^2 (L_p + \frac{1}{2} L_s)\}^{-1}$$

is obtained connecting the unrenormalized coupling constant, g_0 , with the renormalized coupling constant g . Here L_p and L_s are the nucleon and meson cut-offs respectively. When L_p and L_s approach infinity g^2

approaches zero. The argument runs parallel to previous work by the author on electrodynamics (ibid. 103 (1955), 1005-1008; MR 17, 765).

A. S. Wightman.

POMERANCHUK, I.

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✓ 2960
ON CONVERSION TO ZERO OF RENORMALIZED MESON
CHARGE IN PSEUDOSCALAR THEORY WITH PSEUDO-
SCALAR COUPLING. I. Pomeranchuk. Doklady Akad.
Nauk S.S.S.R. 103, 487-488 (1955) Nov. 21. (In Russian) PH
A detailed investigation of properties of G, D, and F with
an arbitrary g^2 is given. The symbols coincide with the
symbols of the previous work by the same author and the
calculations are based on techniques of A. A. Abrikosov
and I. M. Khalatnikov (Doklady Akad. Nauk, 103, 993 (1955)).
The recent calculations of K. A. Ter Martirosyan et al,
after detailed correlation of diagrams of meson scattering
by mesons proved that scattering of mesons by mesons
does not change the conclusion that $g^2 = 0$. (R.V.J.)

Smu ggg

POMERANICHUK, I.Y. and LAIDAU, I.D.

Radiation of gamma quanta during the collision of fast
pions and nuclei (II/51)

CERN-Symposium on High Energy Accelerators and Pion
Physics.

Geneva 11-23 June 56
In. Branch #5

POMERANCHUK, I.Y.

A semi-phenomenological theory of the production of
pion pairs by high energy gamma quanta (II/52)

CERN-Symposium on High Energy Accelerators and Pion
Physics.

Geneva 11-23 June 56
In. Branch #5

Pomeranchuk, I. Ya.

Asymptotics of the Green function of the nucleon and meson in the pseudoscalar theory, at weak interaction.
A. D. Galanin, B. L. Ioffe, and I. Ya. Pomeranchuk. *Soviet Phys., JETP* 2, 37-45 (1955) (Engl. translation). See C.A. 49, 15511c.

B. M. R.

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POMERANCHUK I. YA.

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✓ The number of different types of K mesons. B. L. Ioffe, I. Okun, and I. Ya. Pomeranchuk (U.S.S.R. Acad. Sci., Moscow): *Nuclear Phys.* 2, 277-80 (1956).—Small-angle scattering cross sections of K mesons by deuterons with and without charge exchange are estd. and their bearing on the question of the no. of different types of K mesons is discussed. Possible interpretations are considered for the difference in K -meson scattering by free and bound nucleons.

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R. W. Fink

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POMERANCHUK, I.

"Note on the Number of Different Types of K-Mesons."

USSR Academy of Sciences, Moscow.
Nuclear Physics, 2, No. 3, 1956, p. 261

B. POMERANCHUK, I. YA.

1- pm2

✓ Solution of the equations of pseudo-scalar meson theory
with pseudo-scalar coupling. I. YA. Pomeranchuk. Soviet
Phys. JETP 2, 739-41(1956) (English translation); Zhur.
— Eksp. i Teor. Fiz. 29, 889-71(1955). P. M. D.

pm2
xjc

POMERANCHUK, I. YA.

Pomeranchuk, I. Ya.; Sudakov, V. V.; and Ter-Martirosyan, R. A. Vanishing of renormalized charges in field theories with point interaction. Phys. Rev. (2) 103 (1956), 784-802. 7-17W

The work of Landau, Abrikosov and Khalatnikov [Dokl. Akad. Nauk SSSR (N.S.) 95 (1954), 497-500, 773-776, 1177-1180; MR 16, 315, 316] on the solutions of the quantum field theory equations is here rederived on the basis of a different limiting process involving cutoffs on both meson and nucleon momenta. These results are obtained here by letting the nucleon cutoff tend to infinity more rapidly (at various rates) than the meson one. It is

claimed that the contributions of other than leading terms in the solutions now vanish independently of the size of the unrenormalized coupling constants. It is concluded that both for pseudoscalar and pseudovector coupling meson theories (as well as electrodynamics), the renormalized coupling constants, and with it the interactions, tend rigorously to zero with increasing cutoff momenta (again regardless of the size of the unrenormalized charge). High-energy electron experiments are suggested to discover any breakdown in the theory; this is expected to occur at distances of a fermi, if the cause of the inconsistency is the same for meso- and electrodynamics. S.M.
MT

S. Deser (Copenhagen).

Pomeranchuk, T. Ya.

Emission of γ -quanta which is accompanied by the absorption of fast protons by nuclei. A. I. Akhiezer and T. Ya. Pomeranchuk. *Soviet Phys., JETP* 3, 127-8 (1956) *transl.* See C.A. 50, 14370a. B. M. R.

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Pomeranchuk, I. Ya.

✓588

THE CONSERVATION OF ISOTOPIC SPIN AND THE CROSS
SECTION OF THE INTERACTION OF HIGH-ENERGY π -
MESONS AND NUCLEONS WITH NUCLEONS. I. B. Okun'

and I. Ya. Pomeranchuk (Academy of Sciences, USSR).
Soviet Phys. JETP 3, 507-8(1956) Sept. (In English). Zbor.
Ekspri. i Teoreti. Fiz. 30, 424(1956) Feb. (In Russian)

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POMERANCHUK, I.

743

HIGH ENERGY ELASTIC DIFFRACTION PHENOMENA.
E. L. Feinberg and I. Pomeranchuk (Academy of Sciences of
the USSR, Moscow). Nuovo cimento (10) 3, Suppl. No. 4,
652-71(1956).

A survey is made of recent theoretical papers on processes arising in the course of collisions of high-energy particles. Consideration is given to the electromagnetic phenomena accompanying nuclear collisions, purely electromagnetic processes such as bremsstrahlung, and nuclear phenomena such as meson emission, deuteron splitting, and nucleon-nucleus collisions. (B.J.H.)

LPH

POMERANCHUK, I. Ya.

19
Emission of γ -quanta which is accompanied by the
absorption of fast protons by nuclei. A. I. Akhiezer and
I. Ya. Pomeranchuk. *Zh. Eksp. i Teor. Fiz.* 30, 201-
210 (1956). Math. A formula is derived for the form factor
F as a function of the photon frequency. The formula
makes use of the fact that the dimensions of the proton
are of the order $1/m_0$, where m_0 is the mass of meson, which
is introduced into the calcn. Werner Jacobson

YOM

Pomeranchuk, I. Ya.
USSR/Nuclear Physics - Elementary Particles

C-3

Abst Journal : Referat Zhur - Fizika, No 12, 1956, 33967

Author : Pomeranchuk, I. Ya.

Institution : Academy of Sciences USSR

Title : Isotopic Invariance and Scattering of Antinucleons by Nucleons

Original

Periodical : Zh. eksperim. i teor. fiziki, 1956, 30, No 2, 423

Abstract : Starting with the isotopic invariance and the assumption of high probability of inelastic processes during the collision of the antinucleon with the nucleon, the author shows that the differential cross sections of the elastic scattering of the anti-proton and the antineutron and a proton are equal to each other. The same pertains to the corresponding total cross sections.

Card 1/1

POMERANCHUK, I. Ya.

USSR/ Nuclear Physics - Elemenraty Particles.

C-3

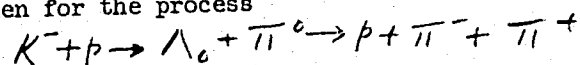
Abs Jour : Ref Zhur - Fizika, No 4, 1957, 8656

Author : Berestetskiy, V.B., Pomeranchuk, I.Ya.

Inst :
Title : Correlative Phenomena in K-Meson Capture

Orig Pub : Zh. eksperim. i teor.-fiziki, 1956, 31, No 2, 350-351

Abstract : If the spin of a Λ particle is greater than one half, then for the process



there occurs a correlation between the directions of the momenta of the (Λ, π^0) and (p, π^-) systems. Formulas are obtained for the case when the spin of the K-meson is 0, its capture takes places in the S-state, and the spin of the Λ -particle is 3/2 or 5/2. If the process takes place in the magnetic field, it becomes possible to determine the magnetic moment of the Λ -particle.

Card 1/1

POMERANCHUK, I.Ya.

CARD 1 / 2

PA - 1448

SUBJECT USSR / PHYSICS
 AUTHOR BERESTECKIJ, V.B., POMERANCHUK, I.JA.
 TITLE The Correlation Phenomena on the Occasion of the Capture of K-Mesons
 PERIODICAL Žurn.eksp.i teor.fiz, 31, fasc.2, 350-351 (1956)
 Issued: 10 / 1956 reviewed: 10 / 1956

The capture of a K-meson by a proton with subsequent decay of the hyperon produced on this occasion, i.e. the reaction $K^- + p \rightarrow \Lambda^0 + \pi^0 \rightarrow p + \pi^- + \pi^0$ can be used for the determination of the spin of the Λ -particle from the angular correlation of the pions.

If the spin of the K-meson is equal to zero, the initial system has the angular momentum 1/2 (if the K-meson is captured in the s-state). The following angular distribution $I_j(\theta)$ then occurs in dependence of the spin j of the Λ -particle and the angle θ between the directions n_1 and n_2 of the momenta with respect to the systems (π^0, π^-) and (p, π^-) respectively (where $I_{1/2}(\theta) = 1$):

$$I_{3/2}(\theta) = 1 + P_2(\cos \theta) \sim 1 + 3 \cos^2 \theta \quad (1)$$

$$I_{5/2}(\theta) = 1 + (8/7)P_2(\cos \theta) + (6/7)P_4(\cos \theta) = 1 - 2 \cos^2 \theta + 5 \cos^4 \theta$$

(Compare the analogous formulae for the decay of the Ξ particle as developed by R.GATTO, Nuov.Cim.2, 841 (1955). If the spin of the K-meson is equal to 1, the initial system may have either the angular momentum 1/2 or 3/2, and therefore the formulae of the angular correlations lose their uniqueness. If the system is in an exterior magnetic field, the dependence of the angular dis-

~~POMERANCHUK, I. Ya.~~ POMERANCHUK, I. Ya.
 SUBJECT USSR / PHYSICS CARD 1 / 2 PA - 1895
 AUTHOR IOFFE, B.L., POMERANCHUK, I. Ya., RUDIK, A.P.
 TITLE The Dispersion Relations for the Scattering of Pions by Deuterons.
 PERIODICAL Zhurn. eksp. i teor. fis, 31, fasc. 4, 712-713 (1956)
 Issued: 1 / 1957

The present work investigates the elastic scattering of pions by deuterons with the scattering angle θ . The dispersion relations which correspond to this process differ as follows from the dispersion relations for the scattering of pions by free nucleons: Firstly, the dispersion relations depend on the polarization of deuterons; and secondly, only one single dispersion relation for the sum of the scattering amplitudes of positive and negative pions is obtained if COULOMB'S interaction is neglected.

Let the real- and imaginary parts of the amplitude of the scattering of pions with the energy ω by deuterons whose spin projection onto the direction of the motion of the pions is equal to m , be denoted by $D_m(\omega)$ and $A_m(\omega)$ respectively.

By using the connection between the real part of the amplitude of scattering into the angle θ and the total cross section $A_m(\omega) = (k/4\pi)\sigma_m(\omega)$, (where $k^2 = \omega^2 - \mu^2$ applies and μ denotes the mass of the meson), the following equation is obtained by the ordinary method for the determination of dispersion relations:

$$D_m(\omega) - D_m(\mu) = (2k^2/\pi) \int_0^\mu \frac{\omega' A_m(\omega') d\omega'}{k'^2(\omega'^2 - \omega^2)} + (k^2/2\pi^2) \int_0^\infty \frac{\omega' \sigma_m(\omega') d\omega'}{(\omega'^2 - \omega^2) k'}$$

POMERANCHUK, Yu. Ya.

"A Semi-Phenomenological Theory of the Production of Pion Pairs
by High Energy Gamma Quanta," paper presented at CERN Symposium, 1956,
appearing in Nuclear Instruments, No. 1, pp. 21-30, 1957

POMERANCHUK, Yu.Ya., LANDAU, L.D.

"Radiation of Gamma Quanta during the Collision of Fast Pions and Nuclei," paper presented at CERN Symposium, 1956, appearing in Nuclear Instruments, No. 1, pp. 21-30, 1957

POMERANCHUK, I. Ya.

5482

CORRELATIVE PHENOMENA IN K-MESON CAPTURE.
V. B. Berestetskii and I. Ya. Pomeranchuk. Soviet Phys.
JETP 4, 289-96(1957) March.

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POMERANCHUK, I. YA.

DISPERSION RELATIONS FOR PIONS SCATTERED BY
DEUTERONS. B. L. Ioffe, I. Ya. Pomeranchuk, and A. P.
Sudak. Soviet Phys. JETP 4, 553-4 (1957) May.

The dispersion relations obtained for the scattering of
pions by deuterons contain, in addition to the constant,
certain effective values of the potential interaction energy
of two nucleons in different states, and these values affect
substantially the value of the singularity term for deuter-
ons, polarized perpendicularly to the incident beams.
(M.H.N.)

small (order of magnitude 10^{-10} ev). For exactly this reason,
transitions $\Lambda_0 \leftrightarrow \Lambda_T$ become possible under the influence of an

CARD 1/3

APPROVED FOR RELEASE: 07/13/2001

CIA-RDP86-00513R001342030006-2"

20-6-18/59

On the Possible Dipole Moment of the Transition at the Λ -
Particles.

external electromagnetic field. If the electromagnetic field
changes only little on a stretch equal to the linear extension
of the Λ -particle, then the transitions of this kind are
effectively reduced to the occurrence of a dipole moment
of the transition:

$$\vec{d} = e r_0 \vec{C}_p.$$

In this context, r_0 stands for a certain constant of the
dimension of a length (it is fixed by the dimensions of the
 Λ -particle), and C_p denotes the operator of the exchange of

$$\Lambda_0 \text{ and } \Lambda_T: C_p = \begin{pmatrix} 0 & 1 \\ 1 & 0 \end{pmatrix}.$$

The existence of a dipole moment at a Λ -particle can lead to a
number of phenomena that can be observed. The authors of the
paper under review first of all deal with the scattering of Λ -
particles by the Coulomb field of the nucleus. The interaction
energy then has the form of $U = - (Ze^2 r_0 / r^3) \vec{r} \vec{C}_p$. The
scattering amplitude is derived in nonrelativistic Born approx-
imation. The differential cross section has the following form
(if the spin of the Λ -particle equals 1/2):

AKHIEZER, A.I.; POMERANCHUK, I.Ya.

Diffraction phenomena during collisions of fast particles with nuclei.
Usp. fiz. nauk 6 no.4:593-630 Ag '58. (MIRA 11:10)
(Collisions (Nuclear physics))

SOV/56-34 -3-29/55

AUTHOR: Pomeranchuk, I. Ya.

TITLE: The Equality of the Total Cross Sections of the Interaction of Nucleons and Antinucleons With High Energies (Ravenstvo polnykh secheniy vzaimodeystviya nuklonov i antinuklonov pri bol'shikh energiakh)

PERIODICAL: Zhurnal Eksperimental'noy i Teoreticheskoy Fiziki, 1958, Vol. 34, Nr 3, pp. 725 - 728 (USSR)

ABSTRACT: Starting from the dispersion relations for the elastic scattering of nucleons on nucleons in the angle zero, it can be shown that the total cross sections of interactions of nucleons and antinucleons must be of the same size with sufficiently high energies. The author investigates here for the sake of certainty the scattering into the angle zero of protons and antiprotons on protons. The corresponding dispersion relation for the scattering amplitude averaged by the spins, is explicitly written down and explained here. When the energy E of the proton, or of the antiproton respectively, tends toward infinite, the total cross sections $\sigma_+(E)$ or $\sigma_-(E)$

Card 1/03

SOV/56-34 -3-29/55

The Equality of the Total Cross Sections of the Interaction of Nucleons and Antinucleons With High Energies

respectively, of the scattering of a proton or antiproton respectively, tend with the energy toward the constant values $\sigma_+(\infty)$, or $\sigma_-(\infty)$ respectively. This is a simple consequence of the fact that all strong interactions with great values of the target parameter (pritsel'nyy parametr) η tend exponentially toward zero. If the weak electromagnetic interaction of a proton and an antiproton would be investigated with a proton, a constant total cross section would be obtained nevertheless also with shielding of the charge of the proton of the target by the atomic electrons with sufficiently high energies. Such a constant cross section would be obtained, however, only with energies of the order of $E \sim M^2/m_e^2 \sim 10^{14}$ eV. But without taking into account the weak electromagnetic interaction, the total cross section attains (with an accuracy up to a value of the order of $e^2 \ln(E/M)$) a constant value already with energies of the order 10^{10} eV. The dispersion relations mentioned at the beginning are then specialized for the case in which the energy E tends toward infinite, and that only the greatest members are taken into consideration. The further discussion

Card 2/3

SOV/56-34-3-29/55

The Equality of the Total Cross Sections of the Interaction of Nucleons and Antinucleons With High Energies

of these relations is followed step by step. The author comes to the following conclusions: The effective cross sections of both antiproton and proton are equal to each other with high energies and a very intense dependence on energy either with one of these cross sections or with both cross sections is to be expected. The relation $\sigma_+(\infty) = \sigma_-(\infty)$ found here, must hold also for the limiting values of the cross sections $\sigma_n(\infty)$ or $\sigma_{\bar{n}}(\infty)$ respectively of neutrons or antineutrons respectively: $\sigma_{\bar{n}}(\infty) = \sigma_n(\infty)$. Analogous considerations hold also for the K-mesons, viz. the mesons K^+ , K^- , K^0 , \bar{K}^0 must have equal total cross sections with sufficiently high energies ($\sim 10^{10}$ eV, if the electromagnetic interaction is not taken into account). Positive and negative pions must analogously have the same cross section with $E \rightarrow \infty$. This conclusion is finally also extended with respect to the hyperons. There are 7 references, 5 of which are Soviet.

Card 3/13

AUTHORS: Okun', L. B., Pomeranchuk, I. Ya. 56-34-4-33/60

TITLE: On the Determination of the Parity of the K-Meson (Ob opredelenii chetnosti K-mezona)

PERIODICAL: Zhurnal eksperimental'noy i teoreticheskoy fiziki, 1958, Vol. 34, Nr 4, pp. 997 - 998 (USSR)

ABSTRACT: The determination of the parity of K-mesons and hyperons is still one of the central problems of the experimental physics of elementary particles. It is possible to speak about only a relative parity of the K-mesons and hyperons viz. about the sign of $P_{K^0 N^0 \Lambda}$, $P_{K^0 N^0 \Sigma}$ etc., because in the case of strong interactions the strangeness is maintained (whereas in the case of weak interactions parity is not maintained. This paper investigates experiment which makes the determination of the sign of $P_{K^0 N^0 \Lambda}$ possible. The authors investigate the capture of a slow K-meson from an S-state; it leads to the reactions $K^- + p \rightarrow \Lambda^0 + \pi^0 + \pi^0 (1)$, $K^- + p \rightarrow \Lambda^0 + \pi^+ + \pi^- (2)$. The parity of the system $\Lambda + 2\pi$ has to be equal to the parity of the system $K + p$, because parity is conserved in the case of strong inter-

Card 1/3

On the Determination of the Parity of the K-Meson

56-34-4-33/60

actions. The authors investigate 2 possibilities: 1) Let it be assumed that $P_{KN\Lambda}^{PP} = +1$. In this case the transition amplitudes for the above mentioned 2 reactions have the form $A_1 = -(a+bp^2+cq^2)/\sqrt{2} + \dots$, $A_2 = (a+bp^2+cq^2) + d\vec{p}\vec{q} + \dots$.

Here \vec{q} denotes the difference of the momenta of the 2 pions and \vec{p} the sum of their momenta, which is equal to the momentum of Λ -hyperon. If for the range in which a strong interaction exists, the validity of the inequality $1/\mu_p < r < 1/\mu_\pi$ is assumed, it is

possible to confine oneself to such terms as do not depend on p and q . It is then true that $A_1 = -a/\sqrt{2}$, $A_2 = a$ and the angular

distributions in both above mentioned reactions are found to be spherically symmetric. The Λ hyperon is not polarized and therefore the angular distribution of the pions forming in the case of the decay of the Λ hyperon is isotropic. For the ratio of the cross sections of the reactions (1) and (2) the ratio $\sigma_2/\sigma_1 = 1.34$ is obtained. 2) Let it be assumed that $P_{KN\Lambda}^{PP} = -1$. The transition amplitude has to have the form

Card 2/3

$A_1 = -a\vec{\sigma}\vec{p}/\sqrt{2}$, $A_2 = a\vec{\sigma}\vec{p} + b\vec{\sigma}\vec{q}$, with $\vec{\sigma}$ denoting Pauli's matrices.

On the Determination of the Parity of the K-Meson

56-34-4-33/60

The differential cross section which result from the computation of the angular distribution in consideration of a possible polarization of the Λ -hyperon are explicitly written down. The cross section of the reaction (1) is still isotropic and does not depend on the polarization of the Λ -hyperon. The Λ -hyperon will be polarized in general and it will be vertical to that plane in which the products of the reactions are located. The number of pions formed in connection with the decay of the Λ -hyperons, as well as of those emitted in an upward and downward direction with respect to the reaction-plane will vary. A formula is given for the angular distribution of the 2 pions and the Λ -hyperon. In conclusion an expression for the ratio is written down (total number of charged pions/total number of neutral pions).

SUBMITTED:

December 11, 1957

1. Mesons---Nuclear reactions

Card 3/3

AUTHORS: Okun', L. B., Pomeranchuk, I. Ya., SOV/56-34-5-27/61
Shmushkevich, I. M.

TITLE: On the Interaction of the Ξ -Hyperons With Nucleons and Light Nuclei (O vzaimodeystvii Ξ -giperonov s nuklonami i legkimi yadrami)

PERIODICAL: Zhurnal eksperimental'noy i teoreticheskoy fiziki, 1958, Vol. 34, Nr 5, pp. 1246 - 1249 (USSR)

ABSTRACT: This work determines the spin-correlations of the Λ -particles occurring in the reaction $\Xi^- + p \rightarrow \Lambda + \Lambda$. In the interaction of a slow Ξ -hyperon with protons the following reactions are possible:
 1) $\Xi^- + p \rightarrow \Xi^- + p$ (elastic scattering)
 2) $\Xi^- + p \rightarrow \Xi^0 + n$ (charge exchange), 3) $\Xi^- + p \rightarrow \Lambda^0 + \Lambda^0$ (absorption).
 The other processes (of the type $\Xi^- + p \rightarrow \Sigma^0 + \Lambda^0$) have a threshold value and for low energies can be neglected. If the Ξ -hyperon is sufficiently long-lived and if experiments with slow Ξ -hyperons are possible the investigation of reaction (3) with an observation of the subsequent

Card 1/3

On the Interaction of the Ξ -Hyperons With Nucleons
and Light Nuclei

SOV/56-34-5-27/61

decay processes of the Λ -hyperons would be of particular interest. The Λ -hyperon is supposed to decay under non-conservation of parity. Expressions for the amplitude of the decay $\Lambda^0 \rightarrow p + \pi^-$ and also for the angular distribution in the decay of a polarized Λ -hyperon are written down. The pions must fly off predominantly in the direction (or opposite to) of the polarisation of the Λ -hyperon. A table contains the spin states and the orbital states of two Λ -hyperons for the case that the Ξ -hyperon is captured by a proton from the S-state. In case of positive parity of the Ξ -particle the amplitude of only one transition

$^1S_0 \rightarrow ^1S_0$) must be considered. A formula for the angular distribution of the pions occurring in the decay of two Λ -hyperons is derived. By comparing this formula with the experimental data the parity of the Ξ -hyperons could be computed. The derived formulae for the process (3) hold in the capture of slow Ξ -particles from a continuous spectrum as well as in the capture from bound states of the system $\Xi^- + p$. The most probable one is

Card 2/3

On the Interaction of the Ξ -Hyperons With Nucleons
and Light Nuclei

SOV/56-34-5-27/61

the decay $\Xi^- + p \rightarrow \Lambda^0 + \Lambda^0 + \gamma$. There are 1 table and 2 references,
1 of which is Soviet.

SUBMITTED: December 10, 1957

1. Particles--Properties 2. Particles--Decay 3. Nuclear spins
--Analysis 4. Mathematics--Applications

Card 3/3

10 (4), 24 (5)

SOV/56-35-2-39/60

AUTHOR: Pomeranchuk, I. Ya.

TITLE: On the Stability of a Fermi Liquid (Ob ustoychivosti fermiyevskoy zhidkosti)

PERIODICAL: Zhurnal eksperimental'noy i teoreticheskoy fiziki, 1958, Vol 35, Nr 1 (7), pp 524-525 (USSR)

ABSTRACT: In Landau's (Ref 1, 2) theory of the Fermi liquid the energy of the system is a functional of the distribution of the excitations with respect to the quantum states (especially with respect to the momenta). The energy functional E is given explicitly for little aberrations δn of the distribution function of the excitations from the equilibrium distribution which corresponds to the occupation of all the states with $p < p_0$. For small δn the stability condition is satisfied if there is $E > 0$ for any δn . The variations of δn (which are taken into account in the above mentioned formula) are connected with the deformations of the Fermi surface and the author obtains the criterion of stability with respect to such deformations. The momentum p is expanded into a series with respect to

Card 1/2

On the Stability of a Fermi Liquid

SOV/56-35-2-39/60

spherical harmonics and an expression is given for the first term of this series. Formulae are then given for the potential energy, for the total energy functional, and for the excitation of the Fermi surface. Finally, an expression is given for the stability condition. The author thanks L. D. Landau discussing this paper. There are 1 figure and 2 references, 2 of which are Soviet.

SUBMITTED: May 7, 1958

Card 2/2.

24(3)

AUTHOR: Pomeranchuk, I. Ya.

SC7/56-35-4-27/51

TITLE: The Isotopic Effect in the **Residual Electrical** Resistance of Metals (Izotopicheskiy effekt v ostatochnom elektricheskom soprotivlenii metallov)

PERIODICAL: Zhurnal eksperimental'noy i teoreticheskoy fiziki, 1958, Vol 35, Nr 4, pp 992 - 995 (USSR)

ABSTRACT: The existence of various isotopes in one metal leads to a difference in the zero vibrations which is in agreement with the isotopic mass differences. This, in turn leads to the dormation of an irregular interference field which can scatter the conductivity electrons. It is therefore possible that an electric residual resistance exists even in crystals containing no physical defects or impurities. Basing upon the investigation of interaction between the electron and the lattice vibrations in an idealized model (without sound dispersion) a formula for the estimation of this residual resistance is derived. Also formulae for the determination of scattering probability and the free

Card 1/2

The Isotopic Effect in the Residual Electrical Resistance of SOV/56-35-4-27/52
Metals

length of path are given. In conclusion, the author
thanks L.D.Landau, Academician, and Yu.V.Sharvin
for discussing the article. There is 1 figure.

SUBMITTED: May 20, 1950

Card 2/2

AUTHORS: Akhiyezer, A. I., Pomeranchuk, I. Ya. SOV/53-65-4-3/13

TITLE: Diffraction Phenomena in Collisions of Fast Particles With Nuclei (Difraktsionnyye yavleniya pri stolknoveniyakh bystrykh chastits s yadrami)

PERIODICAL: Uspekhi fizicheskikh nauk, 1958, Vol. 65, Nr 4, pp. 593 - 630 (USSR)

ABSTRACT: Absorption accompanied by nucleon-nuclei scattering causes an additional disturbance of the incident nucleon wave and independently of a production of compound nuclei leads to an additional elastic scattering of nucleons. Strong absorption of particles occurs when the wavelength λ of the particles is short compared with the radius of the nuclei. In such cases for the incident particles the nucleus is a black or semitransparent body and the elastic scattering of these particles can, according to their absorption by the nuclei, be compared with the diffraction of light in black or semitransparent bodies. Diffraction scattering of fast particles by absorbing nuclei shows up in the purest form in the case of fast neutrons, but in a modified form it also is possible with protons. In this case a diffraction emission

Card 1/1
3

Diffraction Phenomena in Collisions of Fast Particles
With Nuclei

SOV/53-65-4-3/13

of photons takes place. Even more interesting are diffraction phenomena of charged pions scattered at nuclei or single nucleons. Pions of high energy come into intensive interaction with nucleons; pion and nucleon unite to form a short-lived system. The decay products of such systems are mesons and some pairs of nucleons. Diffraction production of mesons and nucleon pairs can also be a consequence of a collision of fast mesons or nucleons with nuclei. In the present paper such phenomena are investigated by wave mechanics. The wave functions of the particles (far away from the nucleus) are written down as superpositions of the incident plane waves with the waves diffracted by nuclei (black or semi-transparent). The analogy with the optical phenomenon makes possible the application of the Huyghens (Gyuygens) principle. The authors try to construct a semi-phenomenological theory of the diffraction phenomena for high energies; this theory bases upon the application of a generalized Huyghens principle. The paper contains the following sections: 1) Introduction, 2) The elastic diffraction scattering, 3) Computation of the nuclear semitransparency, 4) The influence of the Coulomb

Card 2/4

3

Diffraction Phenomena in Collisions of Fast Particles
With Nuclei

SOV/53-65-4-3/13

(Kulon) nuclear field, 5) The Huyghens principle, 6) Diffraction emission of photons by pions (perturbation theory), 7) Emission of photons in dependence on the absorption of pions by nuclei or nucleons, 8) Diffraction production of pion pairs, 9) Diffraction emission of photons by particles with the spin = $1/2$, formation of nucleon pairs, 10) Stopping emission of photons by particles with the spin = $1/2$, 11) Diffraction phenomena in the scattering of fast neutrons at nuclei, 12) The elastic scattering cross section of the diffraction disintegration of deuterons. The stripping cross section at high energies. There are 5 figures and 28 references, 20 of which are Soviet.

Card 3/0

3

ПОМЕРАНЧУК, Т. Я.

SOV/2660

PHASE I BOOK EXPLOITATION

16(1)

1956

Vsesoyuzny matematicheskiy s'ezd. 3rd, Moscow, 1956
Trudy. t. 4: Kratkoye sohraniye sektsionnykh dokladov. Doklady
inostannykh uchastnykh (Transactions of the 3rd All-Union Mathema-
tical Conference in Moscow. vol. 4: Summary of Sectional Reports.
Reports of Foreign Scientists) Moscow, Izd-vo AN SSSR, 1959.
247 p. 2,200 copies printed.

Sponsoring Agency: Akademiya nauk SSSR. Matematicheskii Institut.
Tech. Ed.: G.M. Shvachenko; Editorial Board: A.A. Ibragimov, V.O.
Molchanov, A.M. Vasil'yev, B.V. Medvedev, A.D. Pechenkin, S.M.
Nikol'skiy (Resp. Ed.), G. Postnikov, Yu. V. Ponomarev, K.A.
Kuznetsov, P. L. Ginzburg, V.A. Uspenskiy, N.O. Chetaev, O. Ye.
Shilov, and A.I. Shirshov.

PURPOSE: This book is intended for mathematicians and physicists.
COVERAGE: The book is Volume IV of the Transactions of the Third All-
Union Mathematical Conference, held in June and July 1956. The
book is divided into two main parts. The first part contains a
summary of the papers presented at the conference. The second
part contains the full texts of the reports submitted to the
conference that were not included in the first two volumes. The
second part contains the full texts of the reports submitted to the
conference by non-Soviet scientists. In those cases when the title
of the paper is cited, and if the paper was presented in a previous
volume, reference is made to the appropriate volume. The papers,
both Soviet and non-Soviet, cover various topics in number theory,
algebra, differential and integral equations, function theory,
problems of analysis, probability theory, topology, mathematical
physics, mechanics and physics, computational mathematics, and the
foundations of mathematics, and the history of mathematics.

Makarov, G.I. (Leningrad), V.S. Balashov (Leningrad), E.M.
Grumina (Leningrad), I.A. Molodtsov (Leningrad). Quantita-
tive study of the nonstationary diffraction of waves from
spherical and cylindrical regions 120
Pomeranchuk, T.Ya. (Moscow). The turning to zero of renor-
malized charges in theories with point interaction 120
Rumer, Yu.B. (Novosibirsk). Five-dimensional 122
Skuridin, G.A. (Moscow). On the theory of the r action 122
of elastic waves from a curvilinear boundary 122
Stanyukovich, E.P. (Moscow). Relativistic mechanics and
the electrodynamics of continuous media 124
Rodriguez, L.Sh. (Gallinabad). Singular functions of quan-
tum field theory in n-dimensional pseudo-Euclidean space 124

Card 23/34

21(7)

AUTHORS:

Okun', L. B., Pomeranchuk, I. Ya.

SOV/56-36-1-44/62

TITLE:

On the Peripheral Interactions of Elementary Particles
(O periferiynykh vzaimodeystviyakh elementarnykh chastits)

PERIODICAL:

Zhurnal eksperimental'noy i teoreticheskoy fiziki, 1959,
Vol 36, Nr 1, pp 300-312 (USSR)

ABSTRACT:

By means of the method of analyzing experimental data suggested by the authors it is possible to sort out the contribution made by peripheral interaction. This method is based upon the following well-known fact: Two particles having a large relative orbital momentum l enter into interaction with each other at the distance $\sim l\lambda$, where λ denotes the wave length of the particle. Penetration into shorter distances is prevented by the centrifugal barrier. For the purpose of investigating peripheral interactions it is therefore necessary to sort out that part of the experimental data which determines the amplitude of the process at sufficiently high values of l . The possibility of sorting out and of theoretically describing interaction is based upon 2 particles or 2 systems of particles separated from each other by a sufficiently long distance exchanging

Card 1/4

On the Peripheral Interactions of Elementary
Particles

SOV/56-36-1-44/62

the actually smallest possible number of mesons among each other. The suggested analysis on the basis of orbital momenta permits not only determination of the value of the constant g or of similar constants, but also the determination of the relations between various physical quantities (as e. g. between scattering phases), which characterize one or the other process. With a view of illustrating the suggested method the authors investigate the interaction of two homogeneous scalar particles exchanging scalar mesons between each other. On this occasion, the obviously existing amplitude symmetry (which is due to the equivalence of the particles) was not taken into account. Such an example, which deviates considerably from reality, does, however, not make it possible to investigate such details as are connected with the dependence of the amplitude on spin and on isotopic spin. The ratio between the contributions made by one-meson approximation and two-meson approximation is estimated for large l . In the case of a large l the two-meson amplitude is exponentially small compared to the one-meson amplitude. A more exact analysis of the two-meson amplitude in the case

Card 2/4

On the Peripheral Interactions of Elementary
Particles

SCV/56-36-1-44/62

of a large l will be made in a future paper. Taking isotopic- and spin variables (which are of essential importance in the investigation of concrete processes) into account does not essentially change the results obtained, but only modifies them a little. The further chapters of the paper deal in detail with the interaction of pions and nucleons (scattering of nucleons by nucleons, scattering of antinucleons by nucleons, scattering of pions by nucleons, production of pions in collisions of pions and nucleons), the interaction of strange particles and with pions and nucleons (scattering of hyperons by nucleons, scattering of K-mesons by nucleons, production of K-mesons and pions by K-mesons), the interaction of photons with mesons and baryons (scattering of photons by nucleons, photoproduction of pions, photoproduction of K-mesons, scattering of electrons by nucleons, and production of pions and K-mesons by electrons, interaction with the participation of a neutrino). The authors thank V. B. Berestetskiy, N. N. Bogolyubov, A. F. Grashin, B. L. Ioffe, L. D. Landau, A. P. Rudik, K. A. Ter-Mikaelian and I. M. Shmushkevich for discussions and valuable advice.

Card 3/4

On the Peripheral Interactions of Elementary
Particles

SOV/56-36-1-44/62

The authors further thank Professor Chen for placing a printed copy of his paper at their disposal before its publication. There are 2 figures, 1 table, and 18 references, 6 of which are Soviet.

SUBMITTED: September 20, 1958

Card 4/4

24(3), 24(5)
AUTHORS:

Akhiyezer, A. I., Pomeranchuk, I. Ya.

SOV/56-36-3-32/71

TITLE:

On the Interaction Between Conductivity Electrons in
Ferromagnetics (O vzaimodeystvii mezhdru elektronami pro-
vodimosti v ferromagnetikakh)

PERIODICAL:

Zhurnal eksperimental'noy i teoreticheskoy fiziki, 1959,
Vol 36, Nr 3, pp 859-862 (USSR)

ABSTRACT:

Whereas in ordinary metals mutual attraction between electrons is a consequence of virtual phonon exchange and the matrix element describing interaction energy tends towards an infinite limiting value if the phonon momentum tends towards zero, ferromagnetics show an additional attraction between electrons, and this attraction forms the object of a theoretical investigation in this paper. Additional attraction is a consequence of a virtual emission and absorption of spin waves. As spin wave energy is proportional to the square of their momentum, and as the matrix elements of the emission and absorption of spin waves contain no additional factor that is proportional to the square root of spin wave energy, the matrix element describing the electron interaction energy which depends on the exchange spin waves, is inversely proportional

Card 1/3

SOV/56-36-3-32/71

On the Interaction Between Conductivity Electrons in Ferromagnetics

to the square of the spin wave momentum. In the present paper the character of this effective interaction between electrons in dependence on spin wave exchange is investigated, where the energy operator of interaction between s- and d-electrons is written down in the form $V(\vec{r}) = C s M(\vec{r})$, where s denotes the spin of the s-electrons and $M(\vec{r})$ - the magnetic moment caused by the d-electrons. C is given as $C = \Delta a^3 / \mu_0$, where μ_0 denotes the Bohr magneton, a - the lattice constant, and Δ - an energy ($\Delta \sim \sqrt{\theta A}$) depending on the Curie (Kyuri) temperature. For an energy of the conductivity electrons of the form $\varepsilon(\vec{p}, \sigma) = \varepsilon^0(\vec{p}) + 2\sigma\Delta$ (p = electron momentum, $\sigma = \pm 1/2$, the projection of the spin on to the z-axis, and $\varepsilon^0(\vec{p}) = p^2/2m$) an explicit formula is derived for the matrix element U_{if} which describes the interaction energy. For its maximum $(U_{if})_{\max} = -a^3 U / \Omega$, is obtained with $U = \mu^2 / \theta$, and for the total momentum of an electron pair it holds that $P_0 = \sqrt{p_-^2 - p_+^2} = p_0 \sqrt{2\Delta/\mu}$. There are 1 figure and 7 references, 3 of which are Soviet.

Card 2/3

SOV/56-36-3-32/71

On the Interaction Between Conductivity Electrons in Ferromagnetics

ASSOCIATION: Fiziko-tekhnicheskiy institut Akademii nauk Ukrainskoy SSR
(Physico-Technical Institute of the Academy of Sciences, Ukrainskaya SSR)

SUBMITTED: September 12, 1958

Card 3/3

21(7), 24(5)
AUTHORS:

Berestetskiy, V. B., Pomeranchuk, I. Ya.

SOV/56-36-4-60/70

TITLE:

β -Interaction and Form Factor of the Nucleon (β -vzai nodeystviye i formfaktor nuklona)

PERIODICAL:

Zhurnal eksperimental'noy i teoreticheskoy fiziki, 1959, Vol 36, Nr 4, pp 1321-1322 (USSR)

ABSTRACT:

One of the most characteristic properties of β -interaction is the rapid increase of effectivity with energy. However, the existence of strong interaction leads to an occurrence of form factors in nucleons which may influence the energy dependence of the β -processes considerably. An investigation of β -transformations at high energies, e.g. process (1) of transformation of the electron into a neutrino ($e + p \rightarrow n + \nu$) may serve the purpose of determining these form factors. Today it may be said that the β -interaction consists of V- and A-V-interactions. For process (1) the matrix element in the present "Letter to the Editor" is written down according to references 3 and 4. On the basis of the assumption that the hypothesis developed by Gell-Mann and Feynman (Ref 1) holds good and that the electron energy is supposed to be high as against its own mass, a rather

Card 1/2

β -Interaction and Form Factor of the Nucleon

SOV/56-36-4-60/70

complicated expression is given for the differential cross section of (1). There are 5 references, 1 of which is Soviet.

SUBMITTED: January 6, 1959

Card 2/2

24.6600, 16.8100, 16.7500

76982
SOV/56-37-6-22/55

AUTHORS: Galanin, A. D., Grashin, A. F., Ioffe, B. L., Pomeranchuk, I. Ya.

TITLE: Collision of Nucleons with Large Orbital Momenta

PERIODICAL: Zhurnal eksperimental'noy i teoreticheskoy fiziki, 1959, Vol 37, Nr 6, pp 1663-1679 (USSR)

ABSTRACT: A method of calculation was developed for that part of the nucleon-nucleon scattering amplitude for large orbital momenta $L \gg 1$ which is due to the exchange between two mesons. The connection between this amplitude and the scattering of real mesons by nucleons was established with the aid of the dispersion equations. The method is valid when, besides the condition $L \gg 1$, the inequality $L\mu/p \gg 1$ is also satisfied (here, μ is mass of π -meson; p is momentum of nucleon in the center mass system). The second assumption has a physical meaning: the quasi-classical parameter

Card 1/3

Collision of Nucleons with Large Orbital
Momenta

76982

SOV/56-37-6-22/55

$r_0 = L \xi / \mu \gg 1/\mu$, i.e., it is the condition of the collision periphery. In words, the classification of interactions according to their "degree of periphery" with a small expansion parameter has meaning only when the above condition is satisfied. The main part of the asymptotic expansion parameter for the two-meson phases can be obtained by this method from the small parameter $1/L(L \xi)$, which at low energies ($\xi^2 \gg 1$) is $1/L$, and with an increase in the energy increases up to $1/L \xi$ (when $\xi^2 \ll 1$). The principle of the derivation was that under the above assumption of the virtual meson exchange between nucleons, the main role is played by mesons with physical relation between the energy and the momentum ($\omega^2 - k^2 = \mu^2$), but with nonphysical relation between energy $\omega = 0$ transferred by the momentum $q^2 = 4\mu^2$. Concrete examples of the calculation of two-meson phases and their comparison with the one-meson phases will be reported

Card 2/3

Collision of Nucleons with Large Orbital
Momenta

76982

SOV/56-37-6-22/55

by the authors in their forthcoming paper in this periodical. There are 4 graphs; and 23 references, 11 Soviet, 4 Italian, 1 British, 7 U.S. The 5 most recent U.S. and U.K. references are: S. Mandelstam, Phys. Rev., 112, 1344; 1958; R. Karplus, C. M. Sommerfield, E. H. Wichman, Phys. Rev., 114, 376, 1959; H. J. Bremermann, R. Oehme, J. G. Taylor, Phys. Rev., 109, 2178, 1958; K. Symanzik, Progr. Theor. Phys., 20; 690, 1958; M. L. Goldberger, Proc. of the Sixth. Ann. Rochester Conf., N. Y., 1956.

SUBMITTED: June 12, 1959

Card 3/3

24.6800,16.8300,16.8100

77012

SOV/56-37-6-52/55

AUTHORS: Garibyan, G. M., and Pomeranchuk, I. Ya.

TITLE: Letter to the Editor. Limits in the Adaptation Theory of Transitional Radiation

PERIODICAL: Zhurnal eksperimental'noy i teoreticheskoy fiziki, 1959, Vol 37, Nr 6, pp 1828-1831 (USSR)

ABSTRACT: A retuning of the particle field takes place during the passage of a charged particle from one medium into another. As a result of this a part of the field is separated from the particle, thus forming a transitional emission (cf., V. L. Ginzburg, I. M. Frank, Zhur. eksp. i teoret. fiz., 16, 15, 1946). In an extreme relativistic case, the main part of this radiation is emitted forward in the direction of the particle motion (cf., G. M. Garibyan, Zhur. eksp. i teoret. fiz., 37, 527, 1959). If the particle, for example, passes from a vacuum into a medium, then the spectral distribution of the intensity of the transitional emission is approximately constant in the

Card 1/3

POMERANCHUK, I. Ya.

"Asymptotic Behavior of Effective Cross Sections of High Energies."

report submitted for the 10th International Conference on High Energy Physics,
Rochester, N. Y., 25 Aug - 1 Sep 60

paper to be presented by A. P. Rudik

GALANIN, A.D.; GRASHIN, A.F.; IOFFE, B.L.; POMERANCHUK, I.Ya.

Nucleon-nucleon scattering in two-meson approximation with large
orbital moments. Zhur. eksp. i teor. fiz. 38 no.2:475-488 F '60.
(MIRA 14:5)

(Nucleons--Scattering)

84416

S/056/60/039/004/034/048
B006/B063

24.6520
AUTHORS:

Berestetskiy, V. B., Pomeranchuk, I. Ya.

TITLE:

Asymptotic Behavior of Cross Sections at High Energies

PERIODICAL:

Zhurnal eksperimental'noy i teoreticheskoy fiziki, 1960,
Vol. 39, No. 4(10), pp. 1078 - 1086

TEXT: The data on high-energy particle collisions available at present lead to the assumption that with an increase in energy the total collision cross section tends to a constant limit which is of the order of $1/\mu^2$, where $1/\mu$ is the Compton wavelength of the pion. The elastic diffraction scattering cross section likewise tends to a limit, and the cross sections for the individual inelastic processes tend to zero with an increase in energy. However, these simple assumptions may well be wrong. The present paper gives approximate calculations of cross sections for inelastic processes, which indicate a different asymptotic behavior of the cross sections. As these calculations are only approximative, the conclusions drawn cannot make a claim to finality. They indicate, however, that the situation may be much more complicated. First, the authors study the

Card 1/2

BOROVIKOV, V.A.; GEL'FAND, I.M.; GRASHIN, A.F.; POMERANCHUK, I.Ya.

Phase shift analysis of pp-scattering at 95 Mev. Zhur. eksp. i
teor. fiz. 40 no.4:1106-1111 Ap '61. (MIRA 14:7)
(Protons--Scattering)

NIKITIN, Yu.P.; POMERANCHUK, I.Ya.; SHMUSHKEVICH, I.M.

Formation of high-energy π -meson beams. Zhur.eksp.i teor.fiz.
41 no.3:963-968 S '61. (MIRA 14:10)

(Mesons)

GRIBOV, V. N. and POMERANCHUK, I. Ya.

"On Some Properties of Elastic Scattering Amplitude at High Energies"

Report presented at the Intl. Conference on High Energy Physics, Geneva,
4-11 July 1962

A. F. Ioffe Physico-Technical Institute, Leningrad, USSR (Gribov)
Inst. of Theoretical and Experimental Physics, Moscow, USSR (Pomeranchuk)

NIKITIN, Yu. P., POMERANCHUK, I. Ya., SHIMUSHKEVICH, I. M.

"The Formation of High Energy π - Meson Beams"

report presented at the Intl. Conference on High Energy Physics, Geneva,
4-11 July 1962

Inst. of Theoretical and Experimental Physics, Moscow, USSR

POMERANCHUK, I. YA.

GRINOV, V. N., IOFFE, B. L., POMERANCHUK, I. Ya., AND RUDIK, A. P.

"Some consequences of the Moving Pole Hypothesis for High Energy Processes"

Report presented at the Intl. Conference on High Energy Physics, Geneva,
4-11 July 1962

A. F. Ioffe Physico-Technical Institute, Leningrad, USSR (Gribov)
Institute of Theoretical and Experimental Physics, Moscow, USSR (Ioffe, Pomeranchuk, Rudik)

GRIBOV, V. N. and POMERANCHUK, I. Ya.

"Spin Structure of the Meson-Nucleon and Nucleon-Nucleon Scattering
Amplitudes at High Energies"

Report presented at the Intl. Conference on High Energy Physics, Geneva,
4-11 July 1962

A. F. Ioffe Physico-Technical Institute, USSR (Gribov)
Inst. of Theoretical and Experimental Physics, Moscow, USSR (Pomeranchuk)

POMERANCHUK, I. YH.

S/089/62/013/006/019/027
B102/B186

AUTHORS: G. T. and M. R.

TITLE: Nauchnaya konferentsiya Moskovskogo inzhenerno-fizicheskogo instituta (Scientific Conference of the Moscow Engineering Physics Institute) 1962

PERIODICAL: Atomnaya energiya, v. 13, no. 6, 1962, 603 - 606

TEXT: The annual conference took place in May 1962 with more than 400 delegates participating. A review is given of these lectures that are assumed to be of interest for the readers of Atomnaya energiya. They are following: A. I. Leypunskiy, future of fast reactors; A. A. Vasil'yev, design of accelerators for superhigh energies; I. Ya. Pomeranchuk, analyticity, unitarity, and asymptotic behavior of strong interactions at high energies; A. B. Migdal, phenomenological theory for the many-body problem; Yu. D. Fiveyskiy, deceleration of medium-energy antiprotons in matter; Yu. M. Kogan, Ya. A. Iosilevskiy, theory of the Mössbauer effect; M. I. Ryazanov, theory of ionization losses in nonhomogeneous medium; Yu. B. Ivanov, A. A. Rukhadze, h-f conductivity of subcritical plasma;

Card 1/6

24.6700

3/119

S/056/62/042/004/037/037
B102/B108

AUTHORS: Gribov, V. N., Pomeranchuk, I. Ya.
TITLE: Complex orbital momenta and the relations between the high-energy cross sections of different processes
PERIODICAL: Zhurnal eksperimental'noy i teoreticheskoy fiziki, v. 42, no. 4, 1962, 1141 - 1144

TEXT: Up to now only the properties of $j(t)$ were studied (cf. e. g. Phys. Rev. Lett., 7, 394, 1961) and it was found that the same $j(t)$ are valid for different reactions. Now it is shown that the unitarity conditions for complex j 's (V. N. Gribov, ZhETF, 41, 1962, 1961) yield a great number of relations for $f(t)$ corresponding to different reactions. As a particular case, simple relations between the total interaction cross sections of different particles are obtained for large energies s ($s \rightarrow \infty$), e. g.

$$\sigma_{\pi N}^2 = \sigma_{\pi\pi}\sigma_{NN}, \quad \sigma_{KN}^2 = \sigma_{KK}\sigma_{NN}, \quad \sigma_{\Lambda N}^2 = \sigma_{\Lambda\Lambda}\sigma_{NN}, \quad \sigma_{KA}^2 = \sigma_{KK}\sigma_{\Lambda\Lambda}, \quad (1)$$

$$\sigma_{\Lambda N}/\sigma_{NN} = \sigma_{\pi\Lambda}/\sigma_{\pi N} = \sigma_{KA}/\sigma_{KN}. \quad (2)$$

These relations are derived using the unitarity condition for partial-wave
Card 1/3

Complex orbital momenta ...

S/056/62/042/004/037/037
B102/B108

amplitudes in the annihilation t-channel with $4\mu^2 < t < 16\mu^2$ (μ - pion mass).
The mathematical procedure is demonstrated for the spin-zero \bar{U} and K mesons.

The amplitudes of the partial waves of the reactions $\pi + \pi \rightarrow \bar{\pi} + \pi$, $K + \bar{K} \rightarrow \bar{\pi} + \pi$,
and $K + \bar{K} \rightarrow K + \bar{K}$ are $f_l = \frac{\beta \omega / 2ik}{j - j(l)}$, $g_l = \frac{\beta g_l^*}{j - j(l)}$, $h_l = 2i \frac{k}{\omega} \beta (g_l^*)^2 \frac{1}{j - j(l)}$. (6) with

$$\sigma_{\pi\pi} = 12\pi^2 \frac{1}{\mu^2} r_{\pi\pi}(0), \quad \sigma_{\pi K} = 12\pi^2 \frac{1}{m\mu} r_{\pi K}(0),$$

$$\sigma_{KK} = 12\pi^2 \frac{1}{m^2} r_{KK}(0)$$

(7) it follows that $\sigma_{\pi K}^2 = \sigma_{\pi\pi} \sigma_{KK}$.

The same relations hold also for the differential elastic-scattering cross sections. The relations are valid also for non-zero spin particles (nucleons); a direct experimental verification has not been possible so far owing to the instability of the particles involved. Only the relation $\sigma_{\pi N}^2 = \sigma_{\pi\pi} \sigma_{NN}$ could be verified. Some consequences of these relations are discussed.

Card 2/3

Complex orbital momenta ...

S/056/62/042/004/037/037
B102/B108

ASSOCIATION: Institut teoreticheskoy i eksperimental'noy fiziki Akademii nauk SSSR (Institute of Theoretical and Experimental Physics of the Academy of Sciences, USSR); Leningradskiy fiziko-tekhnicheskij institut Akademii nauk SSSR (Leningrad Physicotechnical Institute of the Academy of Sciences, USSR)

SUBMITTED: February 26, 1962

Card 3/3

37875
S/056/62/042/005/047/050
B108/B138

24 6700

AUTHORS:

Gribov, V. N., Ioffe, B. L., Pomeranchuk, I. Ya., Rudik, A.P.

TITLE:

Some consequences of the pole shift hypothesis for high-energy processes

PERIODICAL:

Zhurnal eksperimental'noy i teoreticheskoy fiziki, v. 42, no. 5, 1962, 1419-1421

TEXT: Some of the relations between the asymptotic values of the total cross sections of various processes are established using the theory of the reaction (R) matrices in the annihilation channel. It was found that in the spin-zero two-particle problem the ratio between any two partial amplitudes $T_{ik}^1(t)$ is uniform (t - square of total energy). Inelastic scattering of two particles yielding one unstable particle in the final state is considered. The behavior of the amplitude is determined by the last pole righthand in the l -plane. The system $\bar{N} + N^*$ may pass over into a "quasi-vacuum" state with isotopic spin $T = 0$, total momentum $j = 0, 2, 4, \dots$, and positive parity. The state where the pole shift

Card 1/3

Some consequences of the pole shift ...

S/056/62/042/005/047/050
B108/B138

$l_0(t)$ determines the total and elastic cross sections at high energies, lies between these states. At high energies the amplitude of the process considered is $f(s,t) = r(t)s^{l_0(t)}$, $l_0(0) = 1$. The cross section of this process is proportional to $\sim \text{const}/(c + \ln(s/4m^2))$; the constant c can be evaluated from experimental data. In accordance with this theory, NN-scattering shows $D_{3/2}$ and $F_{5/2}$ resonances in the energy range 10 - 27 Bev. No $P_{3/2}$ resonance with isotopic spin $T = 3/2$ was observed. Within the framework of this theory this must be due to the absence of "quasi-vacuum" states. The cross section of resonance state productions in processes passing a "quasi-vacuum" state does not decrease with increasing energy. This means that such resonances can also be detected at high energies. For nucleon-nucleus scattering processes the relation $\sigma_{NN} \sigma_{AA} = \sigma_{NA}^2$ is established. In general, $\sigma_{NA} \sim A^{2/3}$ (A - atomic number), but a dependence in proportion with A would not contradict the above relation either.

Card 2/3

Some consequences of the pole shift ...

S/056/62/042/005/047/050
B108/B138

ASSOCIATION: Leningradskiy fiziko-tekhnicheskiy institut Akademii nauk
SSSR (Leningrad Physicotechnical Institute of the Academy of
Sciences USSR) (V. N. Gribov); Institut teoreticheskoy i
eksperimental'noy fiziki Akademii nauk SSSR (Institute of
Theoretical and Experimental Physics of the Academy of
Sciences USSR)

SUBMITTED: March 21, 1962

Card 3/3

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S/056/62/042/006/045/047
B104/B112

AUTHORS: Gribov, V. N., Pomeranchuk, I. Ya.

TITLE: The spin structure of the amplitudes of meson-nucleon and nucleon-nucleon scattering at high energies

PERIODICAL: Zhurnal eksperimental'noy i teoreticheskoy fiziki, v. 42, no. 6, 1962, 1682-1684

TEXT: Based on a few previous papers (V. N. Gribov, ZhETF, 41, 66, 1961; 41, 1962, 1961; V. N. Gribov, I. Ya. Pomeranchuk, ZhETF, 42, 1141, 1962; M. L. Goldberger et al., Ann. of Phys., 2, 226, 1957), the vacuum poles in the expressions for the meson-nucleon and nucleon-nucleon scattering amplitudes are studied from the spin structure and the interrelations between the cross sections. It is shown that for $t = 0$ between the total cross sections one obtains the relations $\sigma_{\pi\pi} \sigma_{NN} = \sigma_{\pi N}^2$ and $\sigma_{KK} \sigma_{NN} = \sigma_{KN}^2$. Exactly the same relations were found between the differential elastic scattering cross sections averaged over the spins. At high energies, polarization vanishes in both types of scattering. If, in addition to

Card 1/2

S/056/62/043/001/042/056
B102/B104

AUTHORS: Gribov, V. N., Pomeranchuk, I. Ya.

TITLE: Some properties of the elastic scattering amplitude at high energies

PERIODICAL: Zhurnal eksperimental'noy i teoreticheskoy fiziki, v. 43, no. 1(7), 1962, 308-318

TEXT: Gribov has already shown (ZhETF, 41, 1962, 1961; 42, 1260, 1962) that in field theory when the Mandelstam representation is used to study the analytic properties of the scattering amplitudes as functions of the energy (t) and of the transferred momentum (s) , the partial wave amplitudes are also functions of the momentum l and that they may have a pole. With high t (and high s) the asymptotic behavior of the scattering amplitude might have the form $f(t)s^{l(t)}$, as was found in T. Regge's non-relativistic theory (Nuovo Cimento, 14, 951, 1959; 18, 947, 1960). These problems are investigated more accurately. It is demonstrated that the imaginary part of the scattering amplitude, $A_1(s, t)$, written as a sum over the partial waves, is positive and has only positive derivatives with respect to t
Card 1/3

S/056/62/043/001/042/056
B102/B104

Some properties of the elastic ...

in the channel in which s is the energy in the non-physical range of the transferred momenta $t > 0$. This holds up to the first singularity, which is determined by the Landau curve $t = t_0(s)$. With $s \rightarrow \infty$, $t_0(s) \rightarrow 4\mu^2$, where μ is the pion mass. The asymptotic behavior in the case of $\pi\pi$ scattering is described by $A_1(s, t) = f(t)s^{l_0(t)}$, where $l_0(t)$ gives the position of the pole of the partial wave $f_1(t)$ in the t -channel. The properties of this $l_0(t)$ are now investigated accurately. As $A_1(s, t)$ and its first derivative $f(t)$ is positive, also dl_0/dt is positive in the interval $0 < t < 4\mu^2$. This holds for the Regge pole with the highest $\text{Re } l$. The behavior of $l_0(t)$ in the neighbourhood of the point $t = 4\mu^2$, which is regarded as an isolated singularity of the $l_0(t)$ -curve, is investigated accurately. It can be proved that, with $t > 4\mu^2$, $l(t)$ exceeds the upper semi-plane in the complex l -plane. All results are obtained without assuming the existence of a Hamiltonian. The behavior of $l_0(t)$ and $A(s, t)$ is discussed for the case that $t \rightarrow \pm \infty$, and that

Card 2/3

244400

AUTHORS:

Gribov, V. N., Pomeranchuk, I. Ya.

TITLE:

Restriction of the amplitude decrement in various processes

PERIODICAL:

Zhurnal eksperimental'noy i teoreticheskoy fiziki, v. 43, no. 4(10), 1962, 1556-1559

TEXT: The expression

$$i_l(t) = \frac{2}{\pi} \int_0^{\infty} Q_l(z) A_1(s, t) dz, \quad (1)$$

$$z_0 = 1 + 8\mu^2/(l - 4\mu^2), \quad z = 1 + 2s/(l - 4\mu^2);$$

for the amplitudes of the partial waves of two particles undergoing transformation into two other particles is studied. For simplicity, two identical particles of mass μ are assumed. When $\text{Re} l > l_0$, where l_0 is the maximum number of subtractions, $\bar{\phi}_1(t) = f_1(t)(t - 4\mu^2)^{-1}$ will satisfy the

Card 1/3

Restriction of the amplitude ...

S/056/62/043/004/058/061
B104/B186

dispersion relation

$$\Phi_l(t) = \frac{1}{\pi} \int_{4\mu^2}^{\infty} \frac{\text{Im } \Phi_l(t') dt'}{t' - t} + \frac{1}{\pi} \int_{-\infty}^0 \frac{\Delta \Phi_l(t') dt'}{t' - t},$$

$$\Delta \Phi_l(t) = 4 \int_{4\mu^2}^{4\mu^2-t} P_l \left(\frac{2s}{4\mu^2-t-i\epsilon} - 1 \right) A_1(s, t-i\epsilon) \frac{ds}{(4\mu^2-t)^{l+1}} + \quad (2)-(3).$$

$$+ \frac{4}{\pi} \int_{s_1(t)}^{s_2(t)} Q_l \left(\frac{2s}{4\mu^2-t-i\epsilon} - 1 \right) \rho(s, u) \frac{ds}{(4\mu^2-t)^{l+1}}.$$

The first integral extends over the lines AC, A'C' (Fig.). The second integral appears only in the relativistic theory and extends over the lines abcd, a'd' in those regions where the Mandelstam spectral function $\rho(s, u)$ is not zero. A detailed study of the poles of $f_1(t)$ and of the dispersion relation (2) shows that in the relativistic theory the amplitudes of the partial waves $f_l(t)$ for any l possess singularities for

Card 2/3

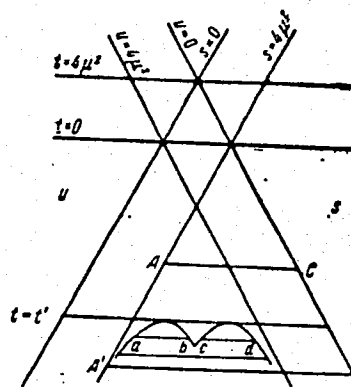
Restriction of the amplitude ...

S/C56/62/043/004/058/C61
B104/B186

$\text{Re} l \geq -1$. Therefore the amplitude of $A(s, t)$ decreases most rapidly if $t = 1/s$. This conclusion holds true of the amplitude in any two-particle process. The reason for such singularities is the existence of three Mandelstam spectral functions in the relativistic amplitude, leading to singularities near negative integer l . There is 1 figure.

SUBMITTED: August 9, 1962

Fig.



Card 3/3

S/056/62/043/005/052/058
B125/B104

AUTHORS: Gribov, V. N., Pomeranchuk, I. Ya.

TITLE: Regge poles and Landau singularities

PERIODICAL: Zhurnal eksperimental'noy i teoreticheskoy fiziki, v. 43,
no. 5(11), 1962, 1970 - 1975

TEXT: This study of the partial wave amplitudes $f_e(t)$ in the scattering of uniform zero-spin particles shows that an infinite number of Regge poles must concentrate along the line $\text{Re } l = -1/2$ if $\sqrt{t} = \sqrt{t_1}$, where $\sqrt{t_1}$ is an arbitrary two-particle threshold and l is the momentum. At the n -particle production threshold an infinite number of poles must concentrate along the line $\text{Re } l = -1/2 - 3/2(n-2)$. Hence, as the momentum s transmitted increases, the invariant scattered amplitude cannot decrease faster than $s^{-1/2}$ if t is equal to an arbitrary two-particle threshold. This statement follows from the unitarity and analyticity. The asymptotic behavior of the absorption part of the scattered amplitude is calculated for $t \sim 4\mu^2$ (μ is

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Card 1/2